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FERRY BUILDING, SAN FRANCISCO

FLETCHER HAMILTON — State Mineralogist

San Francisco] PRELIMINARY REPORT No. 3 [March, 1918

Manganese and Chromium

[SECOND EDITION]

CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO
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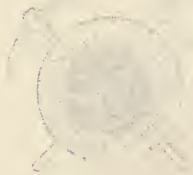

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LETTER OF TRANSMITTAL.

[Second Edition.]

April 1, 1918.

To His Excellency, the HONORABLE WILLIAM D. STEPHENS,
Governor of California.

SIR: The demand for manganese and chromium ores has constantly increased during the past few months, and as a result of the interest taken in this subject and the large number of inquiries which the Bureau has received for information in this regard, this revised edition of Preliminary Report No. 3 has been prepared. The original report, transmitted under date of October 15, 1917, is now entirely out of print.

Respectfully submitted.

FLETCHER HAMILTON,
State Mineralogist.

LETTER OF TRANSMITTAL.

[First Edition.]

October 15, 1917.

To His Excellency, the Honorable William D. Stephens,
Governor of California.

Sir: As a result of present transportation conditions a serious shortage exists in the supply of many mineral substances which were formerly imported, and which are vitally important in the manufacture of munitions and in other industries. The necessity of taking a careful inventory of the nation's resources is rapidly dawning on the mining public. Facts relative to the location of ore deposits, difficulties which must be overcome to make them available for use, and methods to be employed, if their immediate development is demanded, must be correlated.

With the idea in view of rendering all possible assistance in the development of this particular branch of the mining industry, the California State Mining Bureau took up a thorough investigation of manganese and chromium deposits in the state soon after the declaration of war with Germany. The field work has been practically completed, and a detailed report will be made available for distribution at the earliest possible moment. While such report is in course of preparation, it has been deemed advisable to place in form for immediate reference the following data, which, it is hoped, will be of material assistance to all parties interested in this branch of the mining industry. This information will be of direct benefit to the United States Government, at this time of national stress.

Respectfully submitted.

Fletcher Hamilton,
State Mineralogist.

CHAPTER I.

MANGANESE.

Ores.

The most common ores of manganese are the oxides, the carbonates and the silicates. There are also sulphides and phosphates.

Of the oxides, psilomelane and pyrolusite are the most important.

Psilomelane (MnO_2 with MnO, BaO, K_2O and H_2O). Essentially manganese dioxide. Color black or greenish black. Streak reddish or brownish black, and shining. Hardness 5 to 6. Gravity 4.4. Conchoidal fracture. Occurs massive, often associated with pyrolusite and limonite.

A small portion colors the borax bead deep amethyst when hot, and reddish brown when cold. Gives much water when heated in the closed tube. When dissolved in hydrochloric acid (HCl) it gives a white precipitate of barium sulphate upon the addition of sulphuric acid (H_2SO_4).

It is a common manganese mineral, and one of the chief ores in the state. Its characteristic occurrence is in seams and irregular masses in jasper.

Pyrolusite (MnO_2) manganese dioxide. Manganese 63.2%. Oxygen 36.8%. Crystallizes in the orthorhombric system. Generally found fibrous and radiated or divergent. Sometimes small modified prisms. Often massive, in coatings, or as a powder. Color, iron black. Streak black. Submetallic luster. Hardness 2 to 2.5. Gravity 4.8. Splintery fracture.

Colors the borax bead the same as psilomelane. Gives oxygen gas when heated in the closed tube, and very little or no water.

Its softness is a guide to its detection.

Manganite ($Mn_2O_3\,H_2O$) hydrus oxide of manganese. Color, iron black. Dark reddish brown streak. Metallic luster. Hardness 4. Gravity 4.3 Cleavage perfect pinacoidal. Crystallizes as long prisms. Structure generally columnar. Deposits generally consist of black porus ore in masses or lenses in jasper, in metamorphic rocks. Gives water when heated in the closed tube. The prismatic crystallization and the dark brown streak are characteristic.

Braunite ($Mn_2O_3\,MnSiO_3$) Silico oxide of manganese. Contains 69% manganese when pure. Color, black. Streak brownish black. Submetallic luster. Hardness 6.5. Gravity 4.7.

Occurs as small pyramids and also massive.

Siliceous manganese ores are very common in California, and it is probable that this one exists in many localities, but has never been reported.

Finely pulverized braunite is slowly dissolved by hydrochloric acid (HCl), and the solution yields gelatinous silica upon evaporation. Does not give oxygen or water when heated in the closed tube.

Wad is an impure, soft black oxide often found with psilomelane. It occurs as earthy masses or as coatings. Color and streak black, or brownish black. Dull earthy luster. Very soft, hardness 1.6. Gravity 3.4. Soils the fingers. Proportion of manganese dioxide (MnO_2) varies from 30% to 70%.

Rhodochrosite ($MnCO_3$) manganese carbonate. MnO 61.4%. CO_2 38.6%. Color, rose red. Luster vitreous to pearly. Hardness 3.5–4.5. Gravity 3.5. Cleavage perfect rhombohedral. Occurs in small crystals or massive. Generally contains small amounts or iron, calcium, or magnesium. Often found in gold and silver regions associated with the veins.

When treated with dilute hydrochloric acid it effervesces, or gives off carbon dioxide gas (CO_2), and the solution does not yield a jelly-like residue of silica upon evaporation.

Rhodonite ($Mn\ SiO_4$) manganese silicate. Color, rose red, flesh red or brownish. Vitreous luster. Perfect prismatic cleavage. Hardness 5.5–6.5. Gravity 3.5. Generally occurs massive. Often present in copper and silver veins, associated with pyrolusite and psilomelane.

Fuses under the blowpipe to a black glass.

Occurrence.

According to Harder,[1] the characteristic occurrence of manganese in California is in the form of porus black oxide, associated as layers and pockets with the jasper lenses of the Franciscan formation of the Coast Ranges. Smaller deposits are found in the Sierra Nevadas, in veins in the Calaveras formation, as fragments disseminated in auriferous gravels, or in deposits associated with igneous rocks.

Recent investigations made by field assistants of this bureau have fully corroborated the above opinion, although in addition to the examples cited some important deposits of this mineral have been found to occur, in Inyo and San Bernardino counties, as replacements in limestone or along contacts between limestone and granite. The deeper workings of the Ladd and Merchant mines in San Joaquin and Alameda counties are yielding the gray carbonate of manganese, rhodochrosite, as a commercial ore.

Uses.

A large proportion of manganese consumed in the United States has always gone into the manufacture of ferro-manganese, which is

[1]Harder, E. C., U. S. Geol. Sur., Bull. 427; "Manganese Deposits of the United States."

employed in the steel industry. This use is of course more important at the present time than ever before, as the steel alloy containing manganese is particularly important in the manufacture of armor plate, as well as munitions and other war supplies.

This material is also in demand in much lesser degree by manufacturers of glass, electric dry batteries, paints, pottery, tile and brick. These chemical uses require, as a rule, a much higher grade of ore than does the steel industry. The ores best adapted for use in the steel industry should contain more than 40% manganese, and with the exception of phosphorus and silica, no other elements that are commonly present interfere with the use of the ore for this purpose. It is usually specified that ore containing more than 8% silica and two-tenths of 1% phosphorus, is not satisfactory. In the manufacture of dry batteries the usual specifications are that the ore must contain at least 80% manganese dioxide, less than 1% iron, and less than 5% copper, nickel or cobalt. Ore containing more than 1% iron is not adaptable for use in the manufacture of flint glass. Detailed specifications, as required by various consumers in the United States, are given on page 13.

Price.

The average value of manganese ores up to January, 1916, was approximately from $10 to $20 a ton, but since that time the curtailment of ferro-manganese imports from England and the increased demand has caused the price to rapidly rise. Quotation at San Francisco, March 12, 1918, was 70 to 80¢ per unit, based on 40 to 44% metallic manganese, maximum SiO_2, allowable, 8%.

Prices are liable to wide variation, however, and information in this regard should be kept up to date by reference from time to time to the columns of the current technical magazines or trade journals.

Freight rates.

The market for the bulk of the manganese ore produced in California is at the steel-producing centers of the East, although a considerable quantity of this material has recently been purchased by local firms. The freight rate on this class of material from various points in California to the Eastern seaboard is 67½¢ per 100 pounds, in 80,000-pound lots, for ore valued under $50 per ton. To Chicago the corresponding rate is 55¢.

For ore valued at from $50 to $100 per ton the rate is $19.04 per long ton of 2240 pounds to the Eastern seaboard, or 85¢ per 100 pounds. For ore valued at from $100 to $300 per ton the corresponding rate is $1.55 per 100 pounds. For ore valued over $300 per ton the rate is $1.75 per 100 pounds.

Manganese Deposits or Producers.

Name and address of owners or operators	Name and location of property	
Alameda County.		
Beraudiere, John, Livermore		
Davis, John T., 1562 Lincoln av, Alameda		
Levensaler-Speir Co., 259 Monadnock Bldg., S. F.		
McDonald, L. M., Livermore	Livermore Manganese Co.	Livermore
Newhall, E. P., box 354, Livermore	Newhall Manganese Lease	Livermore
Newman, Harry O. D., Livermore		
Overacker, H. T., Livermore		
Amador County.		
Manganese Co. of Cal., 180 Sutter st., S. F.		
Butte County.		
Wooley, George, Clipper Mills	Bear Canyon Mine	Clipper Mills
Glenn County.		
Burrows, I. A., Newville		Newville
Luce, Alonzo, 333 N. Butte st., Willows		
Noyes, A. H., et al., Mechanics Inst. Bldg., S. F.	Rattlesnake Mine	Fruto
Sehorn, A. W., 157 Plumas st., Willows	Black Diamond Mine	
Humboldt County.		
Brewer, Charles, Eureka	Porter Ranch Manganese	Fort Baker
Wood, Wilson, Harris		
Kern County.		
Lovett, T., & Sullivan, G. M., Randsburg	Lovett & Sullivan Group	Garlock
Lake County.		
Holbrook, E. E., Potter Valley	Middle Creek Mining Co.	Upper Lake
Van, George, box 49, Upper Lake	Van Ranch Manganese	
Mendocino County.		
Beck, Mrs. E., Fetters Springs		Redwood
Bowen, Marshall, Hemlock		
Brereton, Charles, Covelo		Covelo
Busch, George, Potter Valley	Independent Mine	Foster Mountain
Busch, J. J. and S. H., Potter Valley	Busch Manganese Deposits	
Busch, J. G. and John, Willits	Busch Deposit	Foster Mountain
Clark, Walter, Covelo		
Connor, Matt, Covelo		
Guss Bros., Calpella		Calpella
Guthrie, Alex, and Root, Mrs. F. M., Alderpoint	Guthrie-Root Chrome Group	Red Mountain
Holbrook, E. E., and Burris, S. E., Potter Valley		Potter Valley
Jameson, James, Covelo		
Manganese Co. of Cal., Adams Bldg., S. F.		
McClendon, Walter, Calpella		Redwood Valley
Morrison, Nat, Covelo		
Noble Electric Steel Co., E. E. Mead, Secy., 995 Market st., San Francisco		Ukiah
Nolan, W., Covelo		
Ochsner, W. H., First Nat. Bank Bldg., S. F.	Busch Deposit	Potter Valley
Requa, Nelson, Redwood Valley, via Calpella		Redwood Valley
Shields, W. E., et al., Covelo	Thatcher Creek Mine	Covelo
Smith, S., and Waldteufel, J. A., Ukiah	Mt. San Hedron Mine	Ukiah
Taylor, Lee, Redwood Valley, via Calpella		Redwood Valley
Thomas, W. P., Ukiah	Thomas Manganese Mine	
Upp, George, Willits		
Waldteufel, J. A., Ukiah	Wild Devil Mine	Ukiah
Merced County.		
Briggs, N. C., Hollister	Hendrick Mine	
Nevada County.		
Loofbourrow, O. E., 719 7th av., Oakland		
Plumas County.		
Altshuler, Samuel, 251 Montgomery st., S. F.		
Boyden, W. P., and Koenig, Fred, Greenville		
Braito, F. E., and Mason, J. F., Crescent Mills	Buster Ryan Manganese	
Clough, L. L., Quincy		Quincy
Kloppenburg, H. A., et al., Quincy		Quincy

Riverside County.

Name and address of owners or operators	Name and location of property	
Black Jack Manganese Mine, Floyd Brown, Supt., Blythe		
Brown, Floyd, Blythe	Maberry-Brown Manganese	English
Kinzie, Robert A., First Nat. Bank Bldg., S. F.		

San Benito County.

Briggs, N. C., Hollister		
Earl, W. C., Windeler Apts., 424 Ellis st., S. F.	Hendricks Manganese Mine	Hollister
Stewart, E. T., South Dos Palos	Hannagan Ranch	Panoche

San Bernardino County.

Brubaker, J. G., 1186 Kingman st., San Bernardino		Ludlow
Fifty Associated Securities Co., Union Oil Bldg., Los Angeles		
Garinger, I. D., Daggett		Daggett
McIlroy, Charles, box 41, Barstow	Concord et al. Manganese Group	
Pacific Minerals Products Co., 301-329 North Avenue 19, Los Angeles		
Seymour, Alf, and Garinger, I. D., Daggett		Daggett
Stenton, Ruben, Silver Lake		Silver Lake
Yeoman, Alex, Silver Lake	Owl Hole Manganese Mine	

San Diego County.

Ruby, Don A., Boulevard	Ruby Manganese Deposit	Boulevard

San Joaquin County.

Western Rock Products Co., Balboa Bldg., S. F.	Ladd Mine	Tesla District

San Luis Obispo County.

Evans, T. and J., San Simeon		San Simeon
Phelan Bros., Cambria		Cambria
Manganese Co. of Cal., 180 Sutter st., S. F.		
Younglove C. A., 1122 Broad st., San Luis Obispo		

Santa Clara County.

Day, Morgan M., 58 N. 15th st., San Jose	Pennsylvania Mine	
Green, Thomas H., R. F. D. 3, Hayward		
Matos, John D., 163 N. 15th st., San Jose		
Mineral Products Co., 334 Rialto Bldg., S. F.		Red Mountain
Plattner, J. H., Livermore		Red Mountain
Wheeler, Harold, Los Molinos	Newhall Mine	Blackbird Valley

Shasta County.

Arps Copper Co., R. V. Montgomery, Mgr., 217 Russ Bldg., San Francisco		Copper City

Sonoma County.

Cooper & Collins, Lessee, via Cloverdale	Haehl Ranch Manganese	
Healdsburg Mineral Co., E. A. Marris, Secy., Healdsburg		
Matthews, Geo. C., Cloverdale		
Patton, Charles, Geyserville		
Shanks, D. W., 1302 Merchants National Bank Bldg., San Francisco		Geyserville
Woods, J. S., Cloverdale		

Stanislaus County.

Hammond, W. J., & Sons, Patterson		
Hampton, John, Patterson		
Manganese Products Co., J. A. Knox, Mgr., Modesto		
Mineral Products Co., 334 Rialto Bldg., S. F.		Red Mountain
Mitchell, Dave, Vernalis	Mitchell Manganese	
Patton, A. W., Patterson		El Puerto Creek
Williams, Carl A., Patterson		Ingram Canyon

Tehama County.

Benner, C. S., and Thurston, D. H., Paskenta	Rosie & Sophie Mine	
Hotel & Hewes, Paskenta		

Trinity County.

Asbil, Frank, Alderpoint	Napher Peak Manganese	
Randolph, B. H., Auto Rest, via Peanut		

Tulare County.

Manganese Co. of Cal., 180 Sutter st., S. F.		

Tuolumne County.

Ogden, B. A., Knights Ferry	Hughes Ranch Manganese	

METALLURGICAL PLANTS.

The Noble Electric Steel Company are making Ferro Manganese at their electric furnace in Heroult, Shasta County, at the rate of about one million pounds a month.

The Pacific Electro Metals Company (Beckman-Linden Corporation) have completed one unit of their electric furnace plant at Bay Point, and have made a small amount of Ferro Manganese in a couple of test runs. They expect to be producing this material on a large scale in the near future, although all work of this character is handicapped at the present time on account of the difficulty of securing electrodes. Beckman-Linden have built a plant at Bay Point, in which they are manufacturing electrodes from lamp black which they secure from gas plants.

CONCENTRATION OF MANGANESE ORES IN CALIFORNIA.

As the search for Manganese ores continues, and as the higher grade deposits become worked out, the question of a successful method of concentrating this material assumes greater importance.

As far as the bureau is informed, there is no actual work of this kind being carried on in California, although at least three firms have been carrying on extensive experiments along this line, and it is quite probable that a successful solution of the problem will be made at no late date.

Professor E. A. Hersam, University of California, Berkeley, has given this matter considerable attention, and the U. S. Bureau of Mines is also investigating ways and means of meeting the Manganese situation, at its Experiment Station in Minneapolis, Minnesota.

MANGANESE CONSUMERS.

In the proper development of any industry it is of course necessary not only that the buyer be advised as to the proper source of the material which will meet his requirements, but also that the producer have adequate information regarding the demand for his raw material, specifications which he may be called upon to meet, and consumers with whom he may get in touch by way of offering his product for sale. In the effort to secure authoritative information in this regard, a copy of the following letter was sent to every buyer and consumer of Manganese of the United States whose name was known to this office:

> Dear Sir: There is now being completed, under my direction, a detailed survey of California's Manganese deposits. At an early date the data thus collected will be issued in printed form.
>
> In order to make this report of the utmost possible value to all concerned at this time of national stress, I am planning to include a list of all firms in the United States who are in the market for this

class of material, as well as a list of producers and owners of deposits. If you have no objection to the use of your name in this connection, an early reply will be appreciated, giving as much of the following information relative to the subject in hand as is consistent with your business policies:

1. Principal use to which you put the material.
2. Specifications covering tenor of ore which will meet your requirements.
3. Form of contract which you demand of the producer.
4. Approximate amount of ore you expect to be in the market for.

It is believed that the dissemination of information of this character will benefit both the user and the producer, and you are assured that your courtesy in complying with the above request will be sincerely appreciated.

(Signed) FLETCHER HAMILTON,
State Mineralogist.

Very full and satisfactory replies were received from the great majority of buyers to whom this letter was sent, and their cooperation is hereby gratefully acknowledged.

The following mentioned consumers do not, of course, make up the total for the industry in the country, and the opportunity to add the names of additional firms in the final report which will be published on this subject, will be greatly appreciated. A cordial invitation is therefore extended to all companies interested in this business, who have not been in touch with the California State Mining Bureau, to advise the State Mineralogist, Ferry Building, San Francisco, regarding the questions mentioned in the above letter.

There follows an alphabetical list of buyers and consumers, with detailed information regarding the requirements of each, as furnished by their representatives.

LETTERS FROM MANGANESE CONSUMERS.

[NOTE.—In the endeavor to revise this publication and place the information contained therein at the disposal of the public at the earliest possible moment, it has not been feasible to again communicate with many of the consumers here listed. The date upon which these letters were written must be taken into consideration. Conditions have changed since the middle of 1917 and statements, especially as to price, undoubtedly will not hold true at the present time.]

American Ever Ready Works: 8th and Brannon Sts., San Francisco, Cal.

Aug. 3, 1917.

"We use Dioxide Manganese Ore, principally in the manufacture of dry batteries. Manganese Ore must come within the following specifications:

Minimum 14.72% available oxygen, 80% MnO_2, maximum 2% iron oxide, not over trace copper or phosphorus.

We have been using some California Manganese as low as 65% MnO_2, but prefer the higher grades.

With reference to the form of contract which we require, we have no particular forms whatsoever, but require the producer to ship his Manganese to San Francisco, where same will be analyzed by any of the reliable chemists of this city, and if found to be up to specifications which are guaranteed by the producer, we immediately pay the invoice.

In regard to the approximate amount of ore we use, this is hard to give you at the present time, as we not only buy for our Pacific Coast factory, but also ship some to our Eastern factories. Our requirements run into the thousands of tons."

The American Metal Company, Limited: 61 Broadway, New York, N. Y. Aug. 16, 1917.

"Our position in this commodity is that of a dealer, having imported and handled large tonnages both of furnace Manganese and Peroxide of Manganese. If you would therefore incorporate our name in your list accordingly, we should appreciate it."

Bethlehem Steel Company: South Bethlehem, Pa. Aug. 11, 1917.

"*Question No. 1*: The only uses to which we put Manganese are for the manufacture of Spiegel, and of Ferro Manganese. Of course you are aware for the manufacture of Spiegel, a low grade Manganiferous iron ore can be used, and ores carrying from 15% to 30% of Manganese are usable.

Questions Nos. 2 and 3: Schedule of prices per ton of 2240 pounds for Domestic or Foreign ores, f. o. b. Philadelphia or Sparrows Point.

49%	Metallic Manganese,	$1.00 per unit
46 to 49%	Metallic Manganese,	.98 per unit
43 to 46%	Metallic Manganese,	.95 per unit
40 to 43%	Metallic Manganese,	.91 per unit

Prices are based on ores containing

not more than 8.00% Silica
not more than .20% Phosphorus

and are subject to deductions as follows:

For each 1% in excess of 8% Silica, ther shall be a deduction of 30 cents per ton, fractions in proportion.

For each .02%, in excess of .20% Phosphorus, there shall be a deduction of 4 cents per unit of Manganese per ton, fractions in proportion.

Ore containing less than 40% Manganese, or more than 12% Silica, or .225 Phosphorus is not acceptable; only purchased at Buyer's option.

Settlements are based on analysis of sample dried at 212 degrees Fahrenheit; the percentage of moisture in the sample as taken to be deducted from the weight.

Question No. 4. We have filled our Manganese requirements for 1917 and 1918. We normally use about 100,000 tons of high grade Manganese Ore annually, and say 70,000 tons of low grade material. By low grade material, I would mean an ore running less than 35% Mn."

Carnegie Steel Company: Pittsburg, Pa. July 31, 1917.

"Replying to your letter of July 25, would say the use to which we put Manganese Ore is the manufacture of Ferro Manganese and Spiegel.

The remainder of your questions are answered by the following price and specification sheet, the last one issued by us, except as to tonnage. This would be a matter of negotiation between shipper and ourselves, but I can say we are large users of high grade Manganese Ore.

We remit in full on receipt of carload and the analysis of the material determined."

[NOTE.—Under date of January 23, 1918, the Carnegie Steel Company advised a California producer that they had discontinued the distribution of their schedule showing prices per unit of domestic manganese ore. The following statement is quoted from the letter mentioned: "At any time you are in a position to make shipments of a trial lot of one to five carloads and will advise us the tonnage, point from which shipment would be made, and analysis in Metallic Manganese, Silica and Phosphorus, which you can safely guarantee your material to contain, naming your lowest price delivered freight prepaid, f. o. b. cars South Chicago, Illinois, the matter will receive proper consideration."]

Dana & Company, Inc.: 111 Broadway, New York, N. Y. July 31, 1917.

"1. Our principal use of Manganese Ore is to make Ferro Manganese, although we sell a considerable quantity of Chemical Ore.

2. The specifications of Metallurgical Ore (Ferro Manganese): 40% Metallic Manganese, 10% maximum Silica, .20% maximum Phosphorus.

We prefer higher Metallic Manganese if possible.

Chemical Ore: Minimum 75%, preferably minimum 80% MnO_2. Maximum 1½% Iron, maximum .01% Copper.

3. The form of contract we demand from the producer depends entirely on his reliability. If we do not know him and he can not give us satisfactory guarantees as to his business integrity, responsibility and knowledge of mining, we will only pay on certified analysis of a reputable chemist, attached to B/L. In general, we are willing to make a fair contract with a responsible supplier, paying him 75 to 80% of the value of his material at point of shipment.

4. There is no limit to the tonnage we can use either of Chemical Ore or Metallurgical."

The Harshaw, Fuller & Goodwin Co.: Cleveland, Ohio. Aug. 6, 1917.

"In answer to your questions would advise as follows:

First—The Manganese Ore we handle is used principally for the manufacture of dry batteries, although we also supply considerable quantities to glass manufacturers and enamelers.

Second—Prior to the beginning of the war, our specifications for Manganese were minimum 85% Manganese Dioxide, maximum 1% Iron, free from Copper. We obtained ore of this description from the Caucasus. Since the war began, we have been unable to obtain ore of the above description, and have used considerable quantities testing a minimum of 80% MnO_2, maximum 1.25% Iron, with a slight trace of Copper. The worst feature about California and other western Manganese is the Copper and high Iron contents.

Third—At present we are not making any contracts with producers.

Fourth—Before the war began we were handling about 10,000 tons of Manganese Ore per year. We now handle perhaps 1,000 tons, most of which has been received from Cuba."

E. J. Lavino & Co.: Bullitt Bldg., Philadelphia, Pa. July 31, 1917.

"In answer to your first question, as to the use to which we put the material, we beg to advise that while we are the largest independent manufacturers of Ferro Manganese in the United States, we are also ore merchants, and while, generally speaking, the Manganese Ore we buy is used in our own furnaces, it might also happen that we would sell some to other Manganese Ore consumers.

Our specifications roughly are as follows:

Ore must be of normal physical condition and must contain no objectionable elements, or at least must not contain in any appreciable quantities any objectionable elements such as copper, lead, zinc, barium, etc.

Metallic Manganese should run as closely to a minimum of 50% as possible, and no ore under 38% in Manganese would be accepted under usual condition.

Silica should be low, averaging as much under 10% as possible, with an outside limit of 13%.

Iron should be just as low as possible, the ideal Manganese Ore for our purpose having no iron in it whatever; 4% is the outside limit we care to accept.

Phosphorus we prefer under .15%, but if necessary can take up to say, .25%.

Alumina should be low, anything over 10% being quite objectionable, especially in conjunction with high silica.

It is our custom to impose a penalty on all Silica above 10%, all Iron above 3%, all Phosphorus above .20%. You understand of course, that in certain cases we might make some modifications in our specification, although we consider the limits as given liberal ones, and we are buying large quantities of ore without finding it necessary to make any change.

Question Three, the form of contract which we ask the producer to sign, we have nothing particularly definite in this way. As long as the contract is equitable, and covers all the points agreed to by both parties, we are usually satisfied. One thing on which we do insist, is that final settlement must be based upon sampling and analyzing by Messrs. A. S. McCreath & Son or Messrs. Booth, Garrett & Blair, upon arrival of car at destination.

Question Four, the amount of ore we expect to purchase at the present time, we are buying unlimited quantities and will probably continue to do so for some time."

A. D. Mackay: 130 Pearl St., New York, N. Y. March 19, 1918.

"I am open for offers on industrial and rare minerals, and at present am especially interested in Mangenese Ore assaying not less than 40% Mn, not over .2% Phosphorous, and not over 8% Silica. Can market 25,000 tons of this grade.

It is very desirable to have average samples and complete analysis of everything offered, together with data as to tonnage available, dates of shipment, prices f. o. b. cars, etc. Samples should be marked plainly for identification inside and outside of package."

J. Meyer & Sons: 480 Bourse Bldg., Philadelphia, Pa. Aug. 2, 1917.

"The principal use to which we put this material is for manufacturing glass. We require an ore running from 78 to 85% MnO_2, with less than 1% of Iron.

Regarding a form of contract, which we would demand from the producer, would state that we would require a contract obligating the producer to forward a definite number of cars at specified intervals.

Regarding the approximate amount of ore would state that we would go slow at the start, in order to compare this ore, in a practical way, to what we are now using."

The Midvale Steel Company: Pittsburg, Pa. Aug. 1, 1917.

"Referring to your letter July 25th addressed to our Philadelphia office, we beg to reply to your questions as follows:

First—Production of Ferro Manganese.

Second—Desirable to secure ore as high as possible in Manganese and as low as possible in Silica, Iron, Phosphates, etc.

Third—Form of contract not an important matter. We are usually willing to meet most any reasonable terms.

Fourth—Our annual requirements are approximately 50,000 tons and we would be very glad to secure the entire quantity in this country, thereby avoiding the importation of any tonnage from Brazil and India."

Noble Electric Steel Company: 995 Market St., San Francisco, Cal.
April 27, 1918.

"In response to a request from your representative, we take pleasure in advising you that our specifications for Manganese Ore are as follows:

Metallic Manganese from 40% up; Silica not over 20%; Iron not over 5%; and Phosphorus limited to .225.

We penalize Silica above 16% and pay a bonus when Silica is below 8%. We can use certain grades of Manganese Ore with Metallic Manganese contents as low as 36%, if Silica is not more than half of the Metallic Manganese content, Iron not over 10%, and a full analysis does not disclose detrimental contents.

We have no particular form of contract, but will quote firm prices for a specific tonnage to responsible people or would consider leasing productive properties on a royalty basis.

We consume about 1500 tons of Manganese Ore per month."

Rogers, Brown & Company: Cortlandt Bldg., 30 Church St., New York, N. Y.
Aug. 3, 1917.

"We shall be glad to have you put our name down in your report as dealers in Manganese Ore. We are not ourselves directly in the manufacturing and smelting end of the business, but act as selling agents for ore producers or as merchants in buying and selling the ore for our own account.

Our principal customers are blast furnaces making Ferro and Spiegeleisen, who require ore running as high as possible in Manganese, not less than 46 or 48%; low in Silica—not over 9% if possible, low in Iron and low in Phosphorus.

As we are not direct consumers, we can not state what amount of ore we expect to be in the market for, but in a general way can assure you that the consumers in this country can use a great deal more high grade ore than it is possible at present to produce in this country.

The domestic production of Ferro Manganese today is in the neighborhood of 27,000 to 28,000 tons per month, requiring more than twice that amount of ore in its production. If British Ferro Manganese continues to be interfered with by the submarine situation, domestic consumption will call for 800,000 to 1,000,000 tons of Manganese Ore for consumption in this country in 1918, so that you will see there is no difficulty in selling all the possible output of Domestic Manganese Ore, provided it is of good quality. The difficulty is that so much of our Domestic Ore runs very low in Manganese, high in Silica, and the deposits are so pockety and deceptive that there seem to be no properties capable of producing a large and continuous output of high grade ore."

Seaboard Steel & Manganese Corporation, 74 Broadway, New York.
Feb. 1, 1918.

Quotation on Manganese Ore and Manganiferous Iron Ore.

Specifications:

The quotations made below are for ore delivered at Temple Furnace, Temple, Pennsylvania, in carload lots, based on a gross ton of 2,240 pounds. The metallic content of ores is to be determined by assay when dried to 212 degrees Fahrenheit, and the amount of moisture to be deducted from the gross weight of ore. Railroad weights are to govern in settlements. Quotations are applicable only to ores of the description given below, which are adapted by physical structure to smelting in a blast furnace, and which are free from elements destructive of their metallurgical value, for the production of commercial Ferro-Manganese.

Quality—Manganese Ore.

Schedule A	50% Metallic Manganese and over	$1.25 per unit, per gross ton
Schedule B	48% to 49.99% Metallic Manganese	1.20 per unit, per gross ton
Schedule C	46% to 47.99% Metallic Manganese	1.20 per unit, per gross ton
Schedule D	44% to 45.99% Metallic Manganese	1.15 per unit, per gross ton
Schedule E	42% to 43.99% Metallic Manganese	1.10 per unit, per gross ton
Schedule F	40% to 41.99% Metallic Manganese	1.00 per unit, per gross ton
Schedule G	38% to 39.99% Metallic Manganese	.90 per unit, per gross ton

The above prices are based on ores containing not more than 8% of Silica, not more than .20% of Phosphorus, and not more than 5% of Iron.

Quality—Manganiferous Iron Ore.

Schedule H	35% to 37.99% Metallic Manganese	$0.70 per unit, per gross ton
Schedule I	32% to 34.99% Metallic Manganese	.65 per unit, per gross ton
Schedule J	22% to 31.99% Metallic Manganese	.60 per unit, per gross ton
Schedule K	10% to 21.99% Metallic Manganese	.60 per unit, per gross ton
Schedule L	5% to 9.99% Metallic Manganese	-- per unit, per gross ton

The above prices are based on ores containing not more than 8% of Silica, and not more than .20% of Phosphorus.

Penalties:

A deduction of 50 cents per gross ton will be made for each 1% of Silica above 8%.

A deduction of 2 cents per unit of Manganese per gross ton will be made for each .02%, or fraction thereof, of Phosphorus above .20%.

A deduction will also be made on all ores received under Schedules A, B, C, D, E, F or G of 50 cents per gross ton for each 1% of Iron above 5%.

Premiums:

A premium of 50 cents per gross ton will be added for each 1% of Silica below 8% on all ores assaying not less than 38% Metallic Manganese.

On Schedules J, K and L an allowance of 8 cents for each 1% of Iron per gross ton, will be added.

Rejection:

Ore containing more than 12% Silica, more than .25% Phosphorus, or, under Schedules A, B, C, D, E, F and G, more than 8% Iron, is subject to acceptance or rejection at the option of the buyer.

Assays:

In case of a dispute as to the assay, the buyer is to have the shipment or shipments sampled and assayed by Messrs. A. S. McCreath & Son, or by Messrs. Booth, Garrett & Blair, whose determination is to be accepted as final by both seller and buyer; the cost of such assay to be borne equally by both parties.

Settlement:

Full settlement will be made by check every Monday morning for all shipments received at the furnace and assayed, not already paid for, up to the close of business the preceding Saturday. On request an advance of 50% of the estimated value of any shipment will be made immediately on receipt at our New York office of draft accompanied by original bill of lading and certificate of analysis of responsible chemist.

Shipping Directions:

Ore is to be consigned to the Seaboard Steel and Manganese Corporation, Temple Furnace, Temple, Pa.; the original bill of lading is to be sent to The Seaboard Steel and Manganese Corporation, 74 Broadway, New York, N. Y., and a copy to Temple Furnace, Temple, Pa. Unless expressly agreed to the contrary, ore is to be loaded in drop-bottom gondolas, or hopper cars.

All shipments are to be billed for Philadelphia and Reading delivery.

All quotations are for immediate acceptance, unless otherwise stated.

PURCHASERS OF MANGANESE AND MANGANIFEROUS ORES OCTOBER 1, 1917.

In addition to the foregoing purchasers of manganese, the following list of firms has been sent out by the U. S. Geological Survey, Washington, D. C., and are included herewith with the idea in view of further broadening the scope of this report.

a Purchase manganese ore with 40 per cent or more manganese and less than 2 per cent iron.
b Purchase manganese ore with 40 per cent or more manganese and 2 per cent or more iron.
c Purchase manganiferous ore with 15 to 40 per cent manganese.

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c Alan Wood Iron & Steel Co., Philadelphia, Pa.
c Algoma Steel Corp., Sault Ste. Marie, Ontario, Canada.
c Alleghany Ore & Iron Co., Buena Vista and Iron Gate, Va.
a American Carbon & Battery Co., East St., Louis, Ill.
a American Ever Ready Battery Co., Long Island City, N. Y.
bc American Manganese Mfg. Co., Bullitt Bldg., Philadelphia, Pa. (or Dunbar, Pa.)
bc American Steel Foundries, McCormick Bldg., Chicago, Ill.
a Anglo-American Flash Light Co., Pittsburgh, Pa.
c James B. Bailey, Pine Forge, Pa.
b Beckman & Linden Engineering Corp., Bay Point, Cal.
ab Bennett-Brooks, 120 Liberty St., New York, N. Y.
ab Berkshire Iron Wks., Bullitt Bldg., Philadelphia, Pa.
bc Bethlehem Steel Corp., South Bethlehem, Pa.
ab Bilrowe Alloys Co., 201 Bernice Bldg., Tacoma, Wash.
ab Binney & Smith, 81 Fulton St., New York, N. Y.
ab Chas. A. Burdick, E. M., 15 Broad St., New York, N. Y.
abc C. F. Burgess Laboratories, Madison, Wis.
a L. H. Butcher & Co., Marine Bldg., San Francisco.

abc Cambria Steel Co., Pittsburgh, Pa.
ab Carnegie Steel Co., Pittsburgh, Pa.
bc Central Iron & Coal Co., Holt, Ala.
bc Charcoal Iron Co., Detroit, Mich.
a Charles B. Crystal, New York, N. Y.
c Cleveland-Cliffs Iron Co., Cleveland, Ohio.
c Colorado Fuel & Iron Co., Pueblo, Colo.
ab W. R. Cuthbert (National Paint & Manganese Corp.), Lynchburg, Va.
bc Delaware River Steel Co., Chester, Pa.
abc W. H. Denison, Cushman, Ark.
b Electric Reduction Co., Washington, Pa.
b Empire Steel & Iron Co., Catasauqua, Pa.
b Fuller & Warren Co., Troy, N. Y.
ab Robert Gilchrist, 82 Beaver St., New York City.
b Goldschmidt Thermit Co., New York, N. Y.
a Charles Hardy, 50 Church St., New York, N. Y.
a Harshaw, Fuller & Goodwin Co., Electric Bldg., Cleveland, Ohio.
a Hazel-Atlas Glass Co., Clarksburg, W. Va.
c W. P. Heath & Co., 509 Olive St., St. Louis, Mo.
bc Hickman, Williams & Co., St. Louis, Mo.
ab C. W. Hill Chemical Co., Los Angeles, Cal.
ab E. C. Humphrey & Co., Detroit, Mich.
a Illinois Pacific Glass Co., San Francisco.
ab Illinois Steel Co., 208 South La Salle St., Chicago, Ill.
a Import Chemical Co., New York, N. Y.
bc Jones & Laughlin Steel Co., Pittsburgh, Pa.
b Juniata Furnace & Foundry Co., 30 West Girard Ave., Philadelphia, Pa.
c La Belle Iron Works, Steubenville, Ohio.
c La Follette Coal & Iron Co., La Follette, Tenn.
bc Lackawanna Steel Co., Buffalo, N. Y.
a J. S. Lamson & Bros., Inc., 80 Maiden Lane, New York, N. Y.
ab E. J. Lavino & Co., Bullitt Bldg., Philadelphia, Pa.
a C. W. Leavitt & Co., 30 Church St., New York, N. Y.
b Lebanon Blast Furnace Co., Lebanon, Pa.
a Levensaler—Speir Corp., Monadnock Bldg., San Francisco, Cal.
ab David Loeser, 1400 Broadway, New York, N. Y.
ab Los Angeles Pressed Brick Co., Los Angeles, Cal.
bc Low Moor Iron Co. of Va., Lowmoor, Va.
b T. L. McCarty, Box 217, Eureka, Utah.
c McKeefrey Iron Co., Leetonia, Ohio.
a Manhattan Electrician Supply Co., 41–47 Morris St., Jersey City, N. J.
abc E. E. Marshall, Bullitt Bldg., Philadelphia, Pa.
ab The Metalores Corp., 56 Pine St., New York, N. Y.
abc Miami Metals Co., Tower Bldg., Chicago, Ill.
ab Mines & Metals Corp., 77 Broad St., New York, N. Y.
c Mississippi Valley Iron Co., 6500 South Broadway, St. Louis, Mo.
bc National Alloy Co., Philadelphia, Pa.
a National Carbon Co., Cleveland, Ohio.
abc Noble Electric Steel Co., 995 Market St., San Francisco, Cal.
c Northwestern Iron Co., Milwaukee, Wis.
a Nungesser Carbon & Battery Co., Cleveland, Ohio.
ab Oaklay Paint Mfg. Co., Los Angeles, Cal.
c Old Dominion Pig Iron Corp., Roanoke, Va.
b Pacific Coast Steel Co., San Francisco, Cal.
abc Pacific Electro Metals Co., Balboa Bldg., San Francisco, Cal.
ab Pacific Sewer Pipe Co., Los Angeles, Cal.
c Perry Iron Co., Erie, Pa.

a Pittsburgh Lamp Brass & Glass Co., Pittsburgh, Pa.
c Pittsburgh Steel Co., Pittsburgh, Pa.
c Pulaski Iron Co., Pulaski, Va.
c Republic Iron & Steel Co., Birmingham, Ala.
ab A. P. Rice, Spencer, Ohio.
b Ricketson Mineral Paint Wks., Milwaukee, Wis.
ab Rogers, Brown & Co., New York, N. Y.
bc Frank Samuel, Philadelphia, Pa.
c John A. Savage & Co., Duluth, Minn.
c Scullin Steel Co., St. Louis, Mo.
abc Seaboard Steel & Manganese Corp., 50 East 42d St., New York, N. Y.
c Seattle Smelting Co., Van Asselt Station, Seattle, Wash.
ab Arthur Seligman, 165 Broadway, New York, N. Y.
bc Shaffer Engineering Co., Nazareth, Pa.
bc Sligo Furnace Co., 915 Olive St., St. Louis, Mo.
c Sloss-Sheffield Steel & Iron Co., Birmingham, Ala.
b C. Soloman, Jr., South San Francisco, Cal.
abc Southern Manganese Corp., Anniston, Ala.
bc Standard Steel Works Co., 11th Floor, Morris Bldg., Philadelphia, Pa.
ab Oscar Stromberg, Tribune Bldg., New York, N. Y.
abc The Suffern Co., Inc., 96 Wall St., New York, N. Y.
ab Superior Portland Cement Co., Concrete, Wash.
c Tacoma Metals Co., Tacoma, Wash.
abc Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
c Thomas Iron Co., Hokendauqua, Pa.
c Toledo Furnace Co., Toledo, Ohio.
a U. S. Glass Co., Pittsburgh, Pa.
bc United States Steel Corp., Empire Bldg., New York, N. Y.
b Utah Iron & Steel Co., Salt Lake City, Utah.
b Vanadium Steel Alloys Co., Latrobe, Pa.
ab Western Reduction Co., Portland, Ore.
b Wharton Steel Co., Morris Bldg., Philadelphia, Pa.
c Wickwire Steel Co., Buffalo, N. Y.
c Wisconsin Steel Co., Harvester Bldg., Chicago, Ill.
c Worth Bros. Co., Widener Bldg., Philadelphia, Pa.

CHAPTER II.

CHROMIUM.

Ores.

Chromite ($FeCr_2O_4$) is the principal ore of chromium, called chromic iron. Oxide of chromium and iron. Color, iron black. Streak grayish brown. Submetallic luster. Breaks with a rough unpolished surface. Hardness 5.5. Gravity 4.5. Is magnetic in small fragments. Imparts to the borax bead a yellowish color when hot, which changes to green when cold.

Occurrence.

The characteristic occurrence of chromium in California is as the black oxide chromite which usually carries more or less iron and magnesium. The ore bodies are usually lenticular or chimney-shaped and occupy openings along fracture planes in peridotite or serpentine. It also occurs along contacts between serpentine and slate or other rock. On account of the continuity of some fractures the ore appears as veins filling them.

On account of the persistent association of chromite with serpentine rocks, the areas in which ore may be expected to occur are easily outlined. One belt follows the Coast Ranges, while another follows the Sierra Nevada Mountains. Up to 1916, California had been the only state in the Union where this ore has been mined on a commercial scale.

Uses.

Like manganese, chromium owes its present important position in the mineral industry of California to the conditions arising from the war. Most of the chromite used in the United States finds a market on the Atlantic seaboard or in the Middle West. The supply was formerly imported from South Africa, Asia Minor, etc. The major consumption of chromite is for use as a refractory lining in furnaces for smelting steel and copper. Lesser amounts go into the manufacture of ferrochrome for chrome-steel alloys, bichromate of soda and potassium, etc.

Price.

Previous to the present war conditions the bulk of the chrome produced was valued at from $8 to $12 per ton.

Quotations at San Francisco March 12, 1918, were 60 to 70¢ per unit, based on 34% to 40% Cr_2O_3, maximum 8% SiO_2, and 90¢ to $1.25 for ore over 40% Cr_2O_3. Recent quotations at New York are from $1.50 to $1.75 per unit for ore carrying 45% Cr_2O_3.

Freight rates.

The principal markets for this product are in the vicinity of St. Louis, Chicago, Pittsburgh and New York.

The freight rate to the Atlantic seaboard is 67½¢ per 100 pound, in 80,000 pound lots for ore valued at $50 per ton or under. Corresponding rate to Buffalo is 60¢, and to Chicago 55¢.

For ore valued from $50 to $100 per ton the rate to the Atlantic seaboard is $19.04 per long ton of 2240 pounds, or 85¢ per 100 pounds.

Chromium Deposits or Producers.

Alameda County.

Name and address of owners or operators	Name and location of property	
Clark, J. W., and McDonald, D., Livermore		Livermore
Newman, S. V., Livermore	Newman Chrome Mine	Cedar Mountain
Olsen, Ole, Livermore	Olsen Chrome Mine	

Amador County.

Courtwright, George, Ione		Ione
Dooley, E. D., Plymouth		
Mefford, J. E., Ione	Mefford Chrome Mine	
Mooney, L., Ione		
Mountain Springs Chrome Co., Ione		
Wait, A. L., Plymouth		

Butte County.

Agard, W. A. T., 268 Market st., San Francisco	Agard & Stewart	Big Bar
Apperson, V. V., Oroville		
Clark, B. O., Yankee Hill	Clark Chrome Mine	Yankee Hill
Davis, A. A., Oroville		
Day, W. S., Oroville		
Dowden, G. O., Oroville		
Dreisbach, F. M., 2101 E. 12th st., Oakland	Zenith Chrome Mining Co.	Forbestown
Holbrook, E. E., 45 Kearney st., San Francisco		Oroville
Hubbard, John D., 832 Mills Bldg., San Francisco	Lucky John Mine	Paradise
Lambert, N., Magalia	Lambert Chrome Mine	Magalia
Marchant, John, Pentz, via Oroville	Curtis Bros. Chrome Mine	Pentz
Nash, E. H., and Vandercook, A. E., 214 First National Bank Bldg., Oakland	Western Ore Co.	
Noyes, A. H., 103 Lick Bldg., San Francisco	Noyes Chrome Mine	
Rohrer, C. C., Pulca		
Sheldon, George E., 302 Key Route Bldg., Oakland		Sterling City
Simmons, D. S., Yankee Hill	Simmons Chrome Mine	Yankee Hill
Stokes, L. R., Yankee Hill	Stokes Chrome Mine	Yankee Hill
Swayne, R. H., 430 Sansome st., San Francisco	Swayne Lumber Co.	Oroville
Wells, John, Yankee Hill	Wells Chrome Mine	Yankee Hill

Calaveras County.

Davis, John, Copperopolis		
Dean, S. P., Felix	Dean Chrome Mine	Felix
Jens, John C., Belmont		Milton
Madrid, John, Angels	True Blue Mine	Angels Camp
McAffee, Mr. —, Valley Springs	Vogelsang Chrome Mine	Valley Springs
McFall, J. H., Angels		Angels
Osburn, S. P., Altaville		Altaville
Peri, Frank, Copperopolis		
Perley, A. C., Fosteria		
Vogelsang & Ellingwood, North Branch	Vogelsang Chrome Deposit	North Branch
Ward, George, Fosteria		

Colusa County.

Rathburn, J. P., College City		

Del Norte County.

Name and address of owners or operators	Name and location of property
American Exploration and Contracting Co., Grants Pass., Ore.	Tyson Chrome Mines
Barton, George S., Grants Pass, Ore.	Barton Chrome Leases
Boutz, M. M., Crescent City	
Gravlin, C. W., Grants Pass, Ore.	Cold Spring Chrome Mine
Hawkins, William, Low Divide, via Crescent City	
Lindley, Jacob, Receiver, Tyson Bldg., Baltimore, Md.	Tyson Mining Co.
Maltby, C. S., 1304 Humboldt Bank Bldg., S. F.	
Moore, Ad., Korbel	Moore-Gastman Chrome Group
	Rattlesnake Mountain
Rowen, R. J., Grants Pass, Ore.	Gordon Mountains
Sowers, H. F., Smith River	Somers Copper Mining Co.

El Dorado County.

Austin, H. C., 56 Bacon Bldg., Oakland	Georgetown
Bonetti Bros., Latrobe	Bonetti Chrome Mine
Brandon, Guy, Latrobe	
Brandon, Madison, Latrobe	Brandon Chrome Mine
Bryant, Cullen, Latrobe	
Chaix, S., Latrobe	
Dodson, R. L., Latrobe	
Evans, John C., Clarksville	
Fleishbein, L., and Kinney, L., Mormon House, via Folsom	
Green, W. C., Georgetown	
Gurney, F., Mgr., box 131, Folsom	Mormon Island
Mundrini, Michael, Latrobe	
Murphy, P. B., Latrobe	
Noble Electric Steel Co., E. E. Mead, Secy., 995 Market st., San Francisco	Bear Mountain, Folsom
O'Brien, James, Latrobe	
Ogle, E. C. and W. H., Volcanoville, via Georgetown	
Pfeiffer, William, Latrobe	
Pilliken, George, Folsom	Pilliken Chrome Deposit
Placer Chrome Co., F. E. Reanier, Supt., Newcastle	Rattlesnake Bar, Newcastle
Wiley, D. E., Folsom	

Fresno County.

Alexander, F. A., 445 Ellis st., San Francisco	Wall Valley
Carson, Frank, Visalia	
Curran, W. E., Sanger	
DeMasters, S. D., Star Route, Sanger	DeMasters Chrome Mine, Pine Flats
Doyle, H. S., Hotel Fresno, Fresno	Watts Valley and Piedra
Johnston, W. J., Bank of San Jose Bldg., San Jose	Johnston Chrome Mine, Piedra
Kahn, Albert, 15 California st., San Francisco	
Levensaler-Speir Co., Monadnock Bldg., S. F.	
Magnesite Mining Co., Coalinga	White Creek Chrome Mine
McBride, C. E., Sanger	
Moore, Vincent, Star Route, Sanger	
Payne, L. R., Academy	
Rhodes, L. H., Coalinga	
Riffe, John, King River, via Sanger	Crisle-Riffe Chrome Mine, Piedra
Sanger Mining Co., John Crisle, Mgr.	Hog Mountain, via Sanger
Siebert, John, Star Route, Sanger	
Snow, C. S., Academy	Snow Chrome Mine
Snyder, R. F., Piedra, via Sanger	
Terrill, William, Trimmer	Trimmer
Vance, Homer, Star Route, Sanger	Vance Chrome Mine, Pine Flats
Wellman, Scott I., 4603 Finley ave., Los Angeles	Chrome Mine, Piedra
Woods, George, Star Route, Sanger	Woods, McGirr & Sherman, Pine Flat

Glenn County.

Burrows, I. A., Newville	Newville
Huffard, J. B., Kohl Bldg., San Francisco	California Chrome Co., Chromeville
Luce, Alonzo, 333 N. Butte st., Willows	
Millsap, O. H., Newville	

Inyo County.

Name and address of owners or operators	Name and location of property	
Roeper, J. C., Independence	Independence Graphite Mine	Kearsarge

Lake County.

Fuqua, T. F., and Bell; R. E., Lower Lake	Chrome Mine	Morgan Valley
Harp, George E., Corcoran	Harp & Sons	
Smith, G. B., Lower Lake		Morgan Valley
Tucker, Henry, Calistoga		

Mendocino County.

Asbil, Frank, Alderpoint		Red Mountain
Graham, W. S., R. F. D. 1, box 70, Ukiah		
Guthrie, Alex, and Root, Mrs. F. M., Alderpoint	Guthrie Root Chrome Group	Red Mountain

Monterey County.

Wear, E. T., Jolon		

Napa County.

Biggs, H. C., 2718 California st., San Francisco		Etna Springs
Chase, H. B., Jr., 412 Mechanics Inst. Bldg., S. F.		
Gill, Charles D., Campbell		Etna Springs
Neill, Thomas, Pope Valley		Knoxville
Nichelini, A., Chiles	White Cape Mine	Chiles Valley
Sawyer Tanning Co., Grant ave., Napa		

Nevada County.

Bechtold, Charles, Washington		
Hoeft, Miss Eleanor, Nevada City		
Hothersall, George J., Nevada City		
Maguire, William, Lowell Hill, via Dutch Flat or Nevada City		
Moscatelli, B., box 309, Nevada City		Washington
Moscatelli, Peter, and Kohler, H., Washington		
Netz, Ludwig, Knowles		
Nevada County Chrome Co., F. S. Morgan, Mgr., Nevada City	Oustomah Mill	
Niles, Walter, Washington		
Olsen Bros., Washington		
Raab, Fred, Washington		
Scott, George, Washington		
Shroeder, H., and Thompson, E. H., Grass Valley		
Sweet, John, Wolf	Sweet Ranch	Wolf
Thompson, H., Wolf		
Williamson Bros. & Cole, Washington	Red Ledge Mine	Washington

Placer County.

Garrison, E. A., Forest Hill	Spanish Mines Consolidated	
Linder, R. E., and Hodges, J. R., Alta		
McNear, F. W., Auburn		
Meyer, Fred, Weimar	Meyer Chrome Mine	Weimar
Scott, George, Washington		Gorge Station
Sullivan, Daniel, Dutch Flat		
Turner, R. Chester, Grass Valley	Turner Chrome Mine	Iowa Hill
Turner, R. L., Colfax		
Walsh, Guy, Auburn		
Wellman, S. I., Hibernian Bldg., Los Angeles		
Williamson, O. S., and Beck, C., Iowa Hill		
Willis, D. E., Lincoln		

Plumas County.

Altschuler, Samuel, 251 Montgomery st., S. F.		
Baldwin, W. T., Telephone Bldg., Oroville		
Diske, Ernest, Gibsonville, via Quincy	Whiskey Diggings Chrome	Gibsonville
Hall, George, Greenville	Gold Stripe Mine	
McCarty, Thomas, Quincy		Quincy

San Benito County.

Aurora Mining Co., via Idria		
Valdez Bros., via Idria	Valdez Bros. Chrome Mine	

San Luis Obispo County.

Name and address of owners or operators	Name and location of property	
Arata, P. A. H., San Luis Obispo	Dibblee & Arata	
California Chrome Co., Kohl Bldg., San Francisco		
Faucher, J. A., Oakland		
Hollister, W. M., and Pierce, W., San Luis Obispo		
Norcross, D. C., 430 California st., San Francisco	Lopez Chrome Group	Chorro District
Parkhurst, Herbert N., 110 20th st., Pacific Grove		
Pierce & Benadom, Morro	Pierce & Benadom Group	Cayucos
Trinidad Mining Co., 214 Front st., San Francisco		
Union Chrome Co., 180 Sutter st., San Francisco		
Van Ness, L. E., Atascadero		
Waters, Charles, San Luis Obispo		
Williams, Joe, Cambria		

Santa Barbara County.

Boeseke, O. W., Santa Barbara		

Santa Clara County.

Ferbrache, J. A., Gilroy		
Holbrook, C. H., and McGuire, W. L., Crocker Bldg., San Francisco		
Jens, John C., Belmont		Coyote
Kilday, M. J., Los Gatos		
Plattner, J. H., Livermore		Red Mountain
Springer, —, Livermore		Mocho

Shasta County.

Alexander, F. A., Adair Hotel, 445 Ellis st., S. F.		
Bland, G. R., and Shoemaker, Lamoine	Bland-Shoemaker Chrome Mine	Gibson
Davis, J. A., Hazel Creek		Sims
Hoy, E. K., Dunsmuir	Hoy Chromite Group	Gibson
Hufford, J. B., Kohl Bldg., San Francisco	California Chrome Co.	Dunsmuir
Miles, D. E., 1515 Lafayette st., Alameda	Miles & Westover Group	Sims
Noble Electric Steel Co., 995 Market st., S. F.	Electric Furnace	Heroult
Solinsky, F. J., 723 New Call Bldg., San Francisco		

Siskiyou County.

Bingham, Alonzo, Callahan		Callahan
Coggins, Arthur L., Dunsmuir	Coggins Chrome Mine	
Collier, B. K., Dunsmuir		
Cory, C. H., and Sexton, Rex, Callahan	Sugar Creek Chrome Mine	Sugar Creek
Doolittle, E. B., Happy Camp	Schular & Doolittle	
Dougherty, O. F., Porterville	Geo. Dexter Chrome Mine	Montague
Dwyer, J. F., Yreka		Yreka
Fiederman, R. and A. G., Yreka	Fiederman Chrome Leases	
Florian and Le May, Charles, box 464, Yreka	Le May Chrome Mine	Grienhorn
Grant, J. M., Etna Mills		
Ladd, J. A., Gottville		
Latchem, E. C., Gazelle	Grouse Creek Mine	Gazelle
Martin, H., and McKean, S., Callahan	Martin, McKean Chrome Mine	
Masterson, T. F. and A. C., Callahan	Masterson Bros.	
McBride, Geo., and Masterson, G. J., Callahan	McBride Chrome Mine	Callahan
Musgrave, Henry, Yreka	Musgrave Chrome Mine	Yreka
Nunes, Joseph, et al., Yreka	Nunes Chrome Mine	
Patterson, James, Callahan		
Strickland, Chester, Callahan		
Tracy Bros., Callahan		
Union Chrome Co., 180 Sutter st., San Francisco		
Welker, Andrew, Callahan		
Welker, O. J., Callahan		

Sonoma County.

Bawman, B. C., Lessee, Cazadero	Parmeter Ranch Mine	Cazadero
Bergman, C. J., Chronicle Bldg., San Francisco		
Bones, W. H., Occidental	Bones Ranch Chrome	
Dolbear, S. H., 1411 Merchants National Bank Bldg., San Francisco		Camp Meeker
Dotta, Mrs. L. H. and Sons, Healdsburg		
Elzey, Ray H., Lessee, Santa Rosa	Riley Ranch Chrome Deposit	Skaggs Springs
Fritz, L. W., Pine Flat		
Madeira, Geo., Sr., R. F. D. 2, Healdsburg	Madeira Mine	Guerneville
Marris, E. A., Secretary, Healdsburg	Healdsburg Mineral Co.	

Stanislaus County.

Name and address of owners or operators	Name and location of property
Butcher, L. H., & Co., 356 Pine st., San Francisco	Patterson
Chrome Concentrating Co., W. R. Stuck, Mgr., Patterson	Patterson
Hampton, John, & Son, Patterson	El Puerto Creek
Holbrook, C. H., and McGuire, W. L., Crocker Bldg., San Francisco	
Mineral Products Co., Robt. Anderson, Gen. Mgr., 334 Rialto Bldg., San Francisco	Red Mountain

Tehama County.

Carpey, Chas., and Brown, J., Lessee, 268 Market st., San Francisco	Tedoc Mining Co	
Folger, A. J., Holbert, C. M., et al., Beegum	Bee Gum Mining Co	Beegum
Kleinsorge, W. E., 605 Peoples Bank Bldg., Sacramento	Kleinsorge Mine	30 miles S.W. of Red Bluff
Noble Electric Steel Co., 995 Market st., S. F.	Lowry Mine	Lowry
Tedoc Chrome Co., via Red Bluff		

Trinity County.

Neeley Bros., 70 Fremont st., San Francisco	Crow Creek Chrome Group	Crow Creek

Tulare County.

Gill, Fred, Exeter		Lindsay
Konrich, Sam, Lessee, Porterville	Vaughn Mine	
Phillips, W. B., Porterville		
Vaughn, D. A., Estate, Porterville	Vaughn Mine	

Tuolumne County.

Atherton, F., Jamestown		
Atkins, Kroll & Co., Insurance Bldg., S. F.		Tuolumne
Beckwith, Robt., Jamestown		
Booker, Powell & Porter, Chinese Camp	Powell et al. Chrome Mine	Chinese
Cory, W. C., Jamestown		
Egling & Minners, Chinese Camp		
Egling & Williams, Chinese Camp	Egling-Williams Chrome Mine	Chinese
Gillis, Charles, Tuttletown	Gillis Chrome Mine	Tuttletown
Kahl, Joseph, Jamestown		
Locklant, William, Jamestown		Jamestown
Mackey, Peter, Jamestown	Mackeys Ranch Mines	
Marianno, J. F., box 6, Chinese Camp		
McCormick Cattle Co., Sonora		
Null, John, Chinese Camp		
Ogden, B. A., Lessee, Knights Ferry	Mackey Ranch Chrome	Jamestown
Pereira, William M., Jamestown		
Pericone, Henry, Chinese Camp		Chinese Camp
Preston Estate, Jamestown		
Quigg, Charles, Chinese Camp	Quigg Chrome Mine	Chinese
Quigg, Charles, Lessee, Jamestown	Kahl Chrome Mine	Rawhide
Richards, George A., Oakdale		
Rushing, R. H., Jamestown	Rushing & Lyons	
Schoettgen, F. J., Columbia		
Sims, Henry, Chinese Camp	Sims Chrome Deposit	Chinese
Staten, George, Jamestown		
Swearer, A., Jamestown		
Terry, C. W., Sonora	Terry-Sell Chrome Mine	

CONCENTRATION OF CHROME ORES.

Deposits of high grade chromite are undoubtedly being worked out to a considerable extent in this state, but during the past few months a great deal of attention has been given to the concentration of lower grade chrome ores. This phase of the industry has already passed the experimental stage, and the following notes will indicate the progress which has been made in this regard:

BUTTE.

Western Ore Co., six miles east of Paradise. A. E. Vandercook and E. H. Nash, First National Bank Bldg., Oakland, Cal.

Data secured March 22, 1918.

Plant being completed which will consist of a 1½ inch grizzly, 6 by 8 inch Dodge crusher, 5 foot Huntington mill, which will be equipped with 20-mesh screens, classifier, the sands to be treated on a No. 4 Deister concentrator, and the slimes on a Johnson vanner. Capacity of plant will be from 30 to 50 tons per 24 hours, and power obtained from a 20 h.p. distillate engine. The ore to be treated assays from 10 to 35 per cent chromic oxide, and the final concentrate will average not less than 45 per cent Cr_2O_3.

CALAVERAS.

Holbrook & Maguire (Dean property), 8 miles southeast of Copperopolis. Office, 1002 Crocker Bldg., San Francisco.

Data secured April 30, 1918.

Plant being completed which consists of a grizzly, crusher, small ball mill and classifier, the subsequent sands and slimes being treated on separate suitable tables, the middlings being returned to the ball mill for retreatment. The ore to be milled will average less than 30% Chromic Oxide, and much of it runs as high as 25% Silica. It is expected to produce a concentrate running from 48% to 50% Chromic Oxide. Gasoline power is utilized.

EL DORADO.

Buzzard Mill, situated on Levy-Darington Ranch, four miles from Mormon Island, El Dorado County (near Folsom).

Plant visited Feb. 20, 1918.

This is an old 5-stamp mill, which has been remodeled as a test plant, an Overstrom concentrator having been installed below the stamps. F. Gurney, Mgr., Box 131, Folsom, Cal. One short trial run has been made, but no definite results yet accomplished. Power derived from two gasoline engines—one 30 h.p. and one 7 h.p. Mr. Gurney is making preparation to build a new plant nearby.

[On April 30 the Bureau was informed that the firm of Holbrook & Maguire had taken over this plant, and was contemplating the con-

struction at an early date of a 60-ton mill, similar to the plant at Copperopolis.]

L. H. Butcher and Company. Mill situated in the town of Folsom. Office, Marine Bldg., San Francisco.
Data secured May 7, 1918.

The mill is a Standard ball mill of 50 to 60 tons capacity, Wilfley concentrators and electric power. A large ore bin has been installed which will hold 250 tons, at the bottom of which is a 14-inch roller Hendy crusher. After going through the crusher the ore will be elevated to the smaller mill bin, and from there through the mill. The company will probably be in a position to buy any ore that may be offered short of the commercial grade where the local freight rate will permit of its being shipped to Folsom. It is expected to produce from 12 to 15 tons of concentrates per day.

Noble Electric Steel Co., 995 Market St., San Francisco. Plant situated in the Nigger Hill District, about 12 miles northeast of Folsom.
Data secured April 26, 1918.

Equipment consists of a Hendy jaw crusher, Allis ball mill, three Wilfrey concentrating tables. Power is derived from a 40 h.p. gasoline engine.

Placer Chrome Concentrating Company, Rattlesnake Bar, El Dorado County. F. E. Reanier, Superintendent; C. A. Doane, Assistant Superintendent, both of Newcastle, Cal.
Plant visited Feb. 21, 1918.

Placer Chrome Concentrating Co. mill, near Rattlesnake Bar, El Dorado Co., Cal. (Photo by C. A. Waring.)

The mill of the Placer Chrome Concentrating Company is located one quarter mile south of Rattlesnake Bridge in El Dorado County, and eight miles southeast of Newcastle, Placer County. Ore is trucked a mile and a quarter from a bin at the foot of the mine tramway. Equipment consists of a 4′x 6′ grizzly, 8″x 12″ Blake crusher, 12″x 18″ rolls, Hendy self-feeder, 4′x 5′ ball mill, 2 Deister-Overstrom concentrators and 1 Deister-Simplex sand concentrator. The mill and crusher are operated by a 20 h.p. Fairbanks Morse distillate engine, while the tables and generator for lights are driven by a 4 h.p. distillate engine. A 6 h.p. engine pumps water from the Middle Fork of the American River.

Forty tons of 25% to 30% ore were recently put through the mill in 24 hours, with the tailings assaying less than 3 per cent chromic oxide. Plant will be enlarged as soon as weather permits.

NEVADA.

Nevada County Chrome Co., Nevada City, operating the Oustomah Mill. F. S. Morgan, Manager. E. E. Leichter, Mill Superintendent.

Plant visited Feb. 22, 1918.

The mill consists of ten 1200-lb. stamps with 15-mesh screens, a Hendy classifier, two Johnson belt machines and one Overstrom table. In several test runs which have been made, there has been no difficulty in milling four tons to the stamp. Average value of ore treated 15% Cr_2O_3, and resulting concentrates are said to average 44% chromic oxide and less than 5% silica, with the tailings running less than 2%. The fines and slimes from the classifier are handled on the Johnson belt machines, and the coarse product is delivered to the Overstrom table. A bucket elevator is now being installed which will return the middlings from the Overstrom back to the classifier. It is also planned to make three cuts at the classifier, and treat the middlings by themselves on an Overstrom table. Mr. Morgan states that as soon as the success of this mill is assured he intends to build another near the company's mines at Limekiln, and continue to operate the Oustomah mill as a custom plant for treating local ores.

PLACER.

F. W. McNear, 5 miles northeast of Auburn. Office, 514 Kohl Bldg., San Francisco, Cal.

Data obtained March 19, 1918.

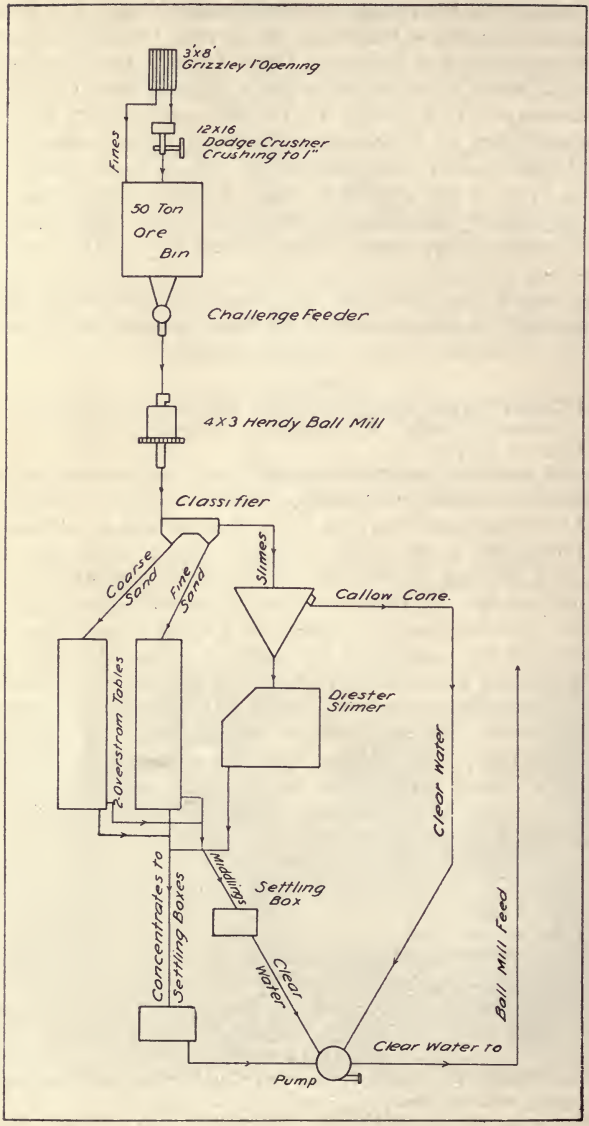
Construction just being started on mill which will be equipped with a ball mill of 50 tons capacity, power to be derived from distillate engine. Average grade of ore which will be treated, about 18 to 20% chromic oxide.

SAN LUIS OBISPO.

California Chrome Co., Castro Mill. San Francisco address, Kohl Bldg.

Data obtained March 26, 1918.

The erection of the California Chrome Company's Castro milling plant was begun the latter part of November, 1917, and was turned



Flow Sheet. Castro Mill; California Chrome Co., San Luis Obispo, Cal.

over to the company, operating to full capacity, by Joshua Hendy Iron Works the first of February, 1918.

The mill is located on San Luisito Creek, about nine miles in a northerly direction from San Luis Obispo in San Luis Obispo County, and is crushing a medium hard low-grade chrome ore, the concentrated chromite from which will be hauled to Gold Tree station, and shipped by rail to Eastern points.

The crude ore is delivered to the mill in 14-cubic-feet ore cars and dumped into a 3′x 8′ grizzly with 1″ openings. The fines going through the grizzly fall directly into the mill feed bin. The coarse is put through a 12″x 16″ Dodge crusher, crushing to one inch. The crusher is set above the mill ore bin, and the product falls directly into the bin, which is of 50 tons live load capacity and built with a flat bottom. The power for the crusher is derived from a 12 h. p. Orr and Sembower gas engine burning distillate for fuel. This enables the crusher to be operated as an independent unit and one shift is generally sufficient to keep the mill bin well supplied with crushed ore.

A Challenge feeder is fastened to the ore bin which feeds the crushed ore to a 4′x 3′ Hendy ball mill. The ball mill has a scoop feed which dips the ore from an iron lined feed box. The mill revolves at 30 revolutions per minute and carries a load of 2000 lbs. chrome steel balls. The consumption of balls is about ½ pound per ton of ore crushed. The pulp from the mill is discharged over a revolving screen with .05-inch openings, and the oversize is returned by a bucket elevator back to the mill feed box. The ball mill, feeder and elevator are driven by a 20 h. p. Doak gas engine which burns distillate for fuel. The engine develops 21 h. p. at this elevation (1500 ft.) and a clutch pulley on the ball mill pinion shaft enables easy starting of the load.

The pulp from the ball mill is delivered by a launder to a two-compartment launder classifier, from which the coarse and fine sands go to two Overstrom concentrating tables and the slimes to a 6-foot Callow dewatering cone. The thickened slime from the cone is put over a Deister slimer. Two products, concentrates and middlings, are taken from the Overstrom tables and tailings are run to waste. Power for the concentrating tables and also for a 1½″ centrifugal pump, for returning clear water, is derived from a 7 h. p. Hercules gas engine, using distillate for fuel.

The water for the mill is pumped from San Luisito Creek to a 10,000-gal. redwood tank by a 4″ Woodin & Little triplex plunger pump, driven by a 6 h.p. Orr & Sembower gas engine, through a 2″ pipe line 700′ long. All water from engine-cooling systems, and clear

water from the dewatering cone and settling boxes, is collected in a sump below the mill and returned by a 1½" Woodin & Little centrifugal pump running submerged, to a 3000-gal. redwood tank, and is used for ball mill feed water. The consumption of water is about 3 tons for each ton of ore ground.

Union Chrome Co. Plant located 17 miles northwest of San Luis Obispo. San Francisco office, 180 Sutter St. E. L. Raymond, Secretary.

Construction was begun December 10, 1917. Equipment consists of a Chilean type ball mill, equipped with 20-mesh screens, and three Gates concentrating tables. Ore is mined in open cuts, trammed from pit to mill, where it is dumped through a grizzly into the ore bin. Capacity of plant, 75 tons in 24 hours. Ore as mined runs from 19 to 23% chromic oxide, 15 to 18 tons of concentrates, averaging 48½% Cr_2O_3 and 2.9% silica, produced daily. Twenty-two men employed.

SANTA CRUZ.

Seashore Metals Syndicate, 8 miles north of Watsonville (Manresa). D. M. Crist, Mgr. Office address, Watsonville, Cal.

Plant visited April 18, 1918.

The beach sands are being treated in a magnetic separation plant with a capacity of 125 tons per day. A daily recovery of five tons of chrome concentrates is being made which will averege 48% chromic oxide and less than 1% silica. Magnetite, titanium, gold and platinum are also being recovered, and the company is planning to build a 1000-ton plant in the near future.

STANISLAUS.

Chrome Concentrating Co., 21 miles west of Patterson. F. E. Harrison, W. R. Stuck, J. T. Carter, owners; main address, Patterson, Cal. San Francisco address, 501 First National Bank Bldg.

Plant visited March 8, 1918.

Plant consists of one 12" Blake crusher and two 5-ft. Huntington mills, which are equipped with 40-mesh screens, and one homemade hydraulic classifier. At the present time both the sands and slimes are being treated on Overstrom concentrating tables. There has been a considerable slime loss, however, and an immediate change is proposed whereby the slimes will be treated in a Dorr thickener, and then on a slime table of some description. At the present time only one of the above-mentioned Huntington mills is being used, and when driven at a speed of 72 revolutions per minute there has been no difficulty in handling one ton of ore per hour. Power is derived from a 35 h. p. distillate engine. The average value of the material treated is from 15 to 20% chromic oxide, while the final concentrate is held at close to 53% Cr_2O_3. Concentrates are sacked at the mill and shipped over the

narrow-gauge line of the Patterson and Western Railway to Patterson. For shipments bound to the East material is then reloaded and emptied out of the sacks, as the latter cost 25¢ each when bought in lots of a thousand.

As soon as the new slime plant is installed and the other Huntington mill placed in operation, Mr. Stuck states that the plant will be in a position to do considerable custom work in addition to handling the company's ores, and he expects to be able to mill approximately 50 tons of ore per day for an indefinite period, as the mines of the Mineral Products Company and various others are located in a convenient distance from his plant.

Mr. Stuck was among the first to attempt chrome concentration in California. He carried on some laboratory experiments in Oakland early in 1917, and started actual work at the property near Patterson in July, 1917, which led up to the present mill.

TEHAMA.

Kleinsorge Chrome Co., 30 miles southwest of Red Bluff.
Data obtained Feb. 20, 1918.

Concentrating plant; construction started November, 1917, not yet completed. W. E. Kleinsorge, owner, Peoples Savings Bank Bldg., Sacramento, Cal. Large tonnage of low grade ore, much of which occurs in magnesite or "magnesium clay." Plant consists of ten 850-lb. stamps and two Wilfley tables. Water power used. Several cars of high grade chrome have already been shipped from this property, after being trucked to Redding.

METALLURGICAL PLANTS.

CONTRA COSTA.

Pacific Electro Metals Co., Bay Point. (Beckman-Linden Eng. Corp., 593 Market St., San Francisco, Cal.)
Plant visited March 6, 1918.

This company has erected a 9′x 15′ electric furnace, using three electrodes, each 17 inches in diameter, requiring from 1000 to 1500 kilowatts for each electrode. The plant has been so constructed that additional units may be easily added as they are required. It is planned to make ferro-manganese and ferro-chrome and silico-manganese at this plant, and while regular production has not yet been established, several experimental runs have been made in which ferro-chrome of the highest quality has been turned out. A fairly low grade of both manganese and chromium ores will be satisfactory for this work. The principal difficulties met with to date have been in obtaining the electrodes. It appears that it is practically impossible to have them shipped from the East, and the company has been bending every effort to perfect the

manufacture of these electrodes from ordinary lamp black which is obtained from any gas plant. Full equipment necessary for this work has been installed, and according to the smelter superintendent the furnace itself will be in full blast at an early date.

NAPA.

Sawyer Tanning Co., Napa, Cal.
Data obtained March 29, 1918.

Manufacturers of bi-chromate of soda. Used in tanning, dyeing and other industries. Plant built in 1916; has been operated about 1½ years.

SHASTA.

Noble Electric Steel Co., Heroult, Cal. San Francisco office, 995 Market St. Electric furnace. Manufacturing ferro-chrome and ferro-manganese.

In addition to the above, the Bureau is informed that the following parties are planning to erect concentrating plants for the treatment of low-grade chrome ores at an early date.

BUTTE.

A. A. Davis, Oroville, Cal.

John D. Hubbard, Lucky John Mine, Paradise. San Francisco address, 832 Mills Bldg.

FRESNO.

C. E. McBride, Sanger, Cal.

L. R. Payne, Associated Warehouse Co., Fresno, Cal.

C. S. Snow, Academy, Cal.

SISKIYOU.

Eugene C. Belknap, Yreka, Cal.

CHROMITE BUYERS AND CONSUMERS.

In the effort to get in touch with consumers similar methods were used as those described on page 12 with reference to manganese. All firms known to the Mining Bureau were communicated with, a statement relative to the Bureau's aims as to the issuance of the report in hand was given, and information asked covering the requirements of each in the purchase of this ore.

Prompt and satisfactory compliance with this request was received almost without exception, and it is with pleasure that the hearty cooperation thus received is hereby acknowledged.

Extracts from letters received follow, which, it is believed, will furnish an authoritative and helpful guide to producers and owners of chromite deposits throughout the state.

LETTERS FROM CHROME BUYERS.

[NOTE.—As mentioned in the chapter on managanese, it has not been possible to again communicate with many of the eastern chromite consumers, and the date of the following letters must be borne in mind in connection with all statements made, especially as regards price.]

American Refractories Company: Joliet, Ill. April 26, 1918.

(Samuel H. Dolbear, Pacific Coast Representative, Merchants National Bank Bldg., San Francisco, Cal.)

Responding to the request of your representative today, I am detailing herewith some changes in the chromite market which have taken place since my letter of July 31, 1917.

Answering the same questions set forth in your letter of July 24, 1917, would advise as follows:

1. The ore is used in the manufacture of fire brick.

2. We are in the market for ore containing 30% or more Chromic Oxide. Eight per cent Silica is the free limit, a penalty of 25¢ per ton being usually attached for each one per cent Silica in excess of 8%, and should the ore carry over 12% Silica it may be rejected at the buyer's option unless prior arrangement has been made to permit a higher Silica content.

3. No fixed form of contract is required. We have discontinued our former plan of paying 80% against shipping documents owing to the fact that under present freight conditions a carload of ore may require three or four months for delivery. We now arrange to have each car sampled as it is being loaded, and full settlement is made on the basis of railroad weights and analysis at point of shipment.

4. With regard to the amount of ore required, our consumption of Chrome Ore this year will probably be limited to the amounts permitted by the War Industries Board. I understand that twelve to fifteen thousand tons has been allotted for refractory use, and the portion of this which we will supply is, of course, problematical.

Binney & Smith: 81 Fulton St., New York, N. Y. July 30, 1917.

Replying to yours of the 24th inst. regarding Chromite, the chief use we have for the material in question is in the manufacture of Chrome colors, Ferro Chromium and refractories. We need about 500 tons of ore of over 50% Cr_2O_3 and under 3% in Silica annually while the war lasts. We can take all the chrome we can get 38% to 40% Cr_2O_3.

Electro Metallurgical Company: 42d St. Bldg., New York, N. Y. Aug. 9, 1917.

(California Chrome Co., Pacific Coast Representatives, Kohl Bldg., San Francisco, Cal.)

(1) Question: Principal use to which we put the material.

Answer: In the production of steel.

(2) Question: Specifications covering tenor of ore which will meet our requirements.

Answer: High grade.

(3) Question: Form of contract which we demand of the producer.

Answer: No particular form.

(4) Question: Approximate amount of ore we expect to be in the market for.

Answer: All we can obtain at a reasonable price.

[NOTE.—On April 9, 1918, the California Chrome Company placed an ad. in the San Francisco *Examiner* which contained the statement that they "will contract for the balance of this year for chrome ore at a minimum of $1.25 per unit for 38% chromic oxide and upward. Premiums will be paid for early delivery. Advances will be made on good prospects for development work. Settlements in full will be made on independent chemists' sampling and analysis on receipt of bills of lading and weight certificate."]

Foote Mineral Company: 107 N. 19th St., Philadelphia, Pa. Aug. 3, 1917.

1. Principal Uses: Manufacture of Ferro-chrome and bichromate.

2. Specifications: Chemical ore (for manufacture of bichromate): Cr_2O_3 minimum 50%, Silica maximum 6%; Metallurgical Ore: Cr_2O_3 minimum 40%, Silica maximum 5%, Sulphur maximum .5%, Phosphorus maximum .2%.

3. Contracts. The ore is generally purchased on the basis of so much per unit of Cr_2O_3 present per net ton. For example, ore quoted at 80¢ per unit on the basis of a minimum of 50% Cr_2O_3, would be worth $40.00 per net ton f. o. b. Eastern points. Payment is generally made on the basis of 80% against bill of lading with preliminary certificate of sampling and analysis by a Western chemist. Final payment would be made on the basis of Booth, Garrett & Blair's or Ledoux & Co.'s certificate of sampling and analysis after the arrival of the ore in the East.

In regard to the fourth question, it is impossible for us to give you any exact information, as our requirements vary from month to month.

Goldschmidt Thermit Company: New York City, 120 Broadway. Aug. 24, 1917.

1. The principal use for which we require California Chrome Ore is the making of 60% Carbon-free Ferro Chromium.

2. We prefer the ore to be over 50% Cr_2O_3, less than 1½ SiO_2 and only trace of S and P and containing no injurious metals.

3. The contract form which we prefer is one covering all possible points between buyer and seller, such as specifications, delivery, quantities, etc., etc., and we prefer to pay 100% on the dry weight after weighing, sampling and analysis by third and independent party whose results are final.

4. We would probably require at least 10 to 20 carloads per year.

Harbison-Walker Refractories Company: Farmers Bank Bldg., Pittsburg, Pa. July 30, 1917.

We beg to reply to the questions in your letter of the 24th inst. as follows:

1. Principal use: Brick making.
2. Specifications: Cr_2O_3 not under 40%.
   SiO_2 not over 6%.
   Fe_2O_3 not over 15%.
3. Form of contract: 80% against sight draft with bill of lading and certificate of analysis attached; balance on determination of quality of ore after arrival.
4. Amount in market for: Can not state. Large user.

A. D. Mackay: 130 Pearl St., New York, N. Y. March 19, 1918.

I am open for offers on industrial and rare minerals, and at present am especially interested in obtaining chromite which contains 50 per cent Cr_2O_3. Could also use a large tonnage of 40 per cent ore.

Complete analysis desirable, especially as regards silica, iron and magnesia content. It is very desirable to have average samples of everything offered, together with data as to tonnage available, dates of shipment, prices f. o. b. cars, etc. Samples should be marked plainly for identification inside and outside of package.

Mutual Chemical Co. of America: 55 John St., New York, N. Y. July 30, 1917.

1. The use to which we put Chrome Ore is in the manufacture of Bichromate of Potash and Bichromate of Soda.
2. All we use should analyze a minimum of 48% Chromic Oxide and maximum of 6% Silica.
3. The form of contract depends upon whether it is a buyer's or seller's market. We buy as well as we can, and on the best terms possible, generally delivered at our works, weighed and sampled at time of discharging, and settlement on sampling and analysis of Messrs. Ledoux & Company's laboratory.
4. We believe we are the largest concumers of Chrome Ore in this country. We do not care to state our consumption.

The National Electrolytic Co.: Niagara Falls, N. Y. Aug. 17, 1917.

Referring to your letter of July 24th, which has been overlooked, we can use 10,000 tons Chrome Ore per annum in the manufacture of Bichromates. We prefer to have ore testing about 50% Cr_2O_3.

Noble Electric Steel Company: 995 Market St., San Francisco, Cal. April 27, 1918.

Our specifications are as follows:

Chromic Oxide from 38% up, with Silica not over 10%.

As we are operating our own properties for Chrome Ore, we are not in the market to purchase ore but will consider taking over productive properties, or good prospects upon a royalty basis.

Pacific Electro Metals Company: Balboa Bldg., San Francisco, Cal. July 25, 1917.

We are in the market for a limited amount of Chrome Ore, for the purpose of manufacturing Ferro Chromium from the same.

As to specifications of ore which we would use, beg to state that we would insist on a low Silica content and as high Metallic Chromium content as possible.

The form of contract which we would demand of the producer would be one based on guaranteed minimum of Metallic Chromium and maximum Silica. We would most likely be willing to pay some premium for ores better than the quality contracted for. Our demands would be approximately one hundred tons of ore per month.

St. Louis Refractories Company: Title Guaranty Bldg., St. Louis, Mo. Aug. 4, 1917.

Replying to your recent favor, relative to Chrome, will state that we intend to make some Chrome Brick, but have not an opening for it in our plant just at present, but we do handle Chrome Ore, and are in the market for about 1,000 tons of 34% to 40%.

The Sawyer Tanning Company: Napa, Cal. July 28, 1917.

Replying to your questions:

(1) All Chromite purchased by us is used in the production of Bichromate of Soda in our factory at Napa.

(2) We can use Chromite only when containing 47% or more of Chromic Oxide and not over 8% of Silica.

(3) We have no particular form of contract with the producers.

(4) We expect to be in the market for 2,000 tons of ore yearly.

The Sherwin-Williams Co.: 601 Canal Road, N.W., Cleveland, Ohio. March 12, 1918.

Our requirements are such that the most satisfactory grade of ore for our use is from 45% to 50% with not more than 5% Silica. We convert the ore into Bichromate of Soda.

Price determines the quantity we can use; under the circumstances, it would be difficult to name any exact tonnage in which we would be interested, but we estimate it would be in the neighborhood of 500 or 600 tons a year, possibly 1000 tons.

PUBLICATIONS OF THE CALIFORNIA STATE MINING BUREAU.

Publications of this Bureau upon which a price has been affixed will be sent on receipt of the requisite amount. Others will be mailed upon request until the edition is exhausted. Only stamps, coin or money orders will be accepted in payment.

Money orders should be made payable to the STATE MINING BUREAU.

Personal checks will not be accepted.

REPORTS.

Asterisk (*) indicates the publication is out of print.

			Price.
*Report	I.	Henry G. Hanks. 1880.	
*Report	II.	Henry G. Hanks. 1882.	
*Report	III.	Henry G. Hanks. 1883.	
*Report	IV.	Henry G. Hanks. 1884.	
*Report	V.	Henry G. Hanks. 1885.	
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